



Research in Software Measurements

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List of topics

- Introduction
- Current status
- Convertibility
- Tools Survey
- Innovative uses in quality

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List of topics

- COSMIC - Introduction:
 - History
 - Key Concepts
 - Examples of uses for benchmarking and estimation
- Current status
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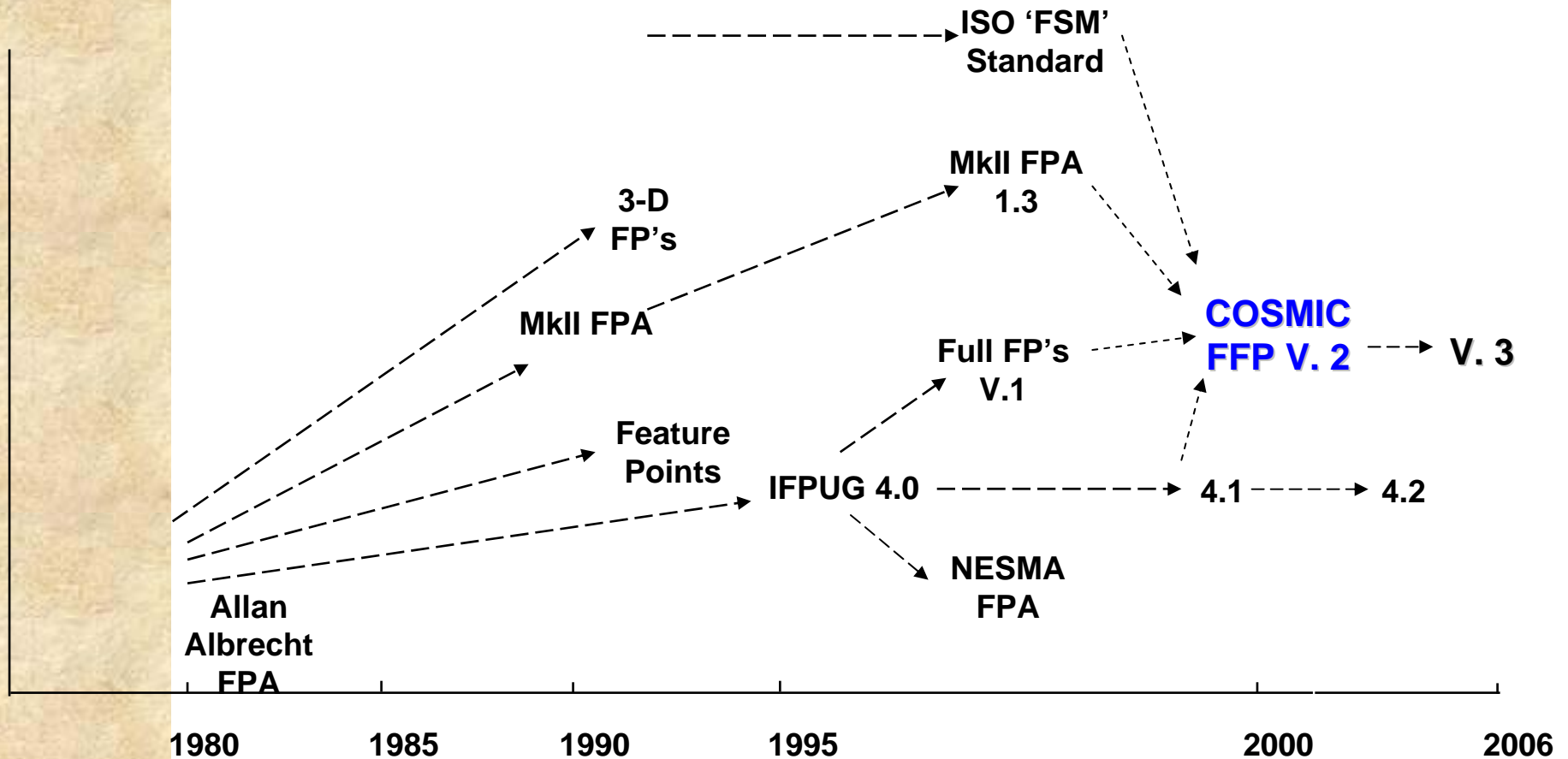
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Evolution of Functional Size Methods – ISO standards



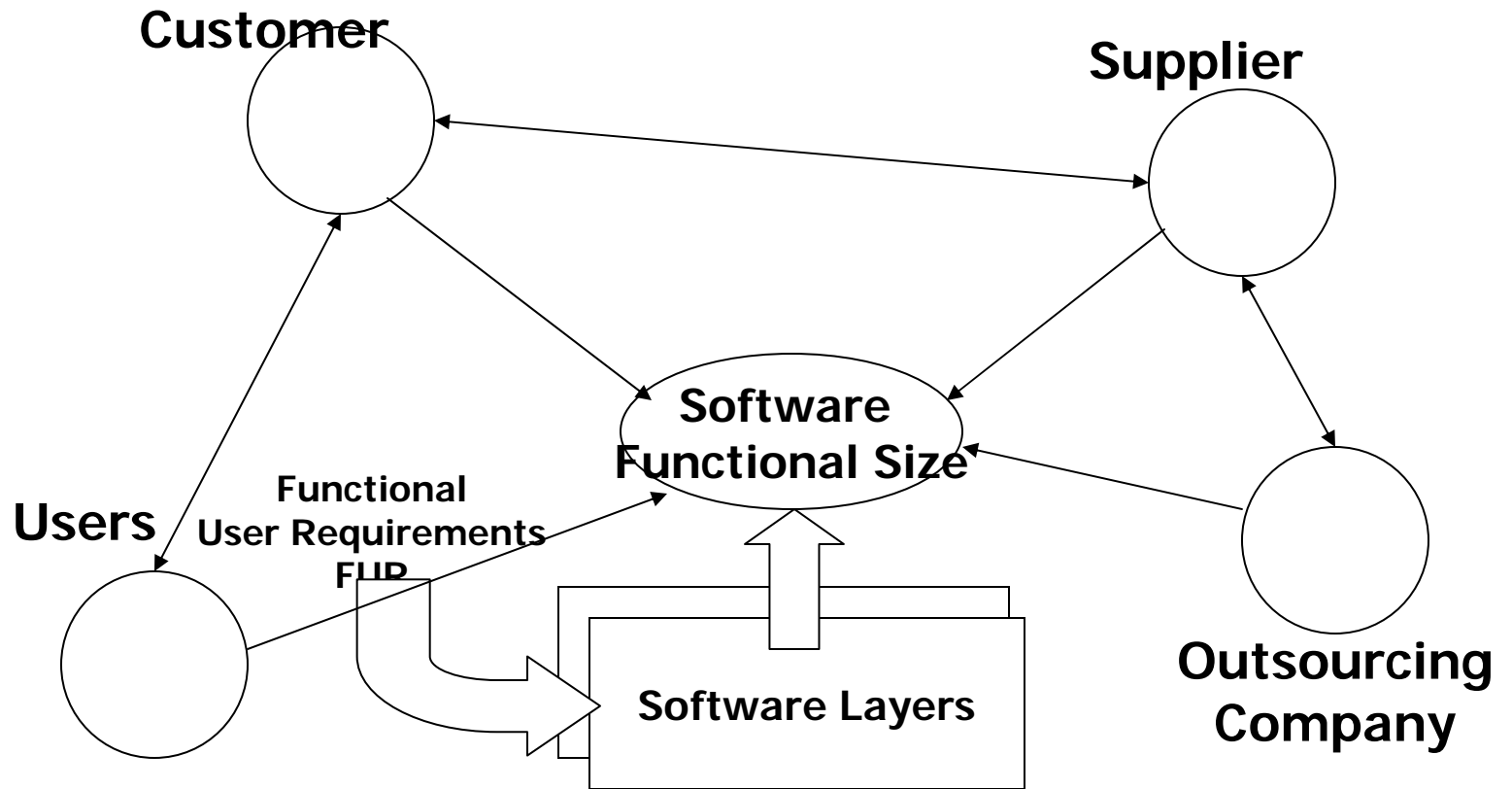
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Concurrent Viewpoints



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Measurement Viewpoints

COSMIC can handle all the viewpoints:
You must select the relevant one, and document it when recording the measurement results.

Examples:

- Supplier
- Customer
- Human
- Sub-contractor,
- Etc.

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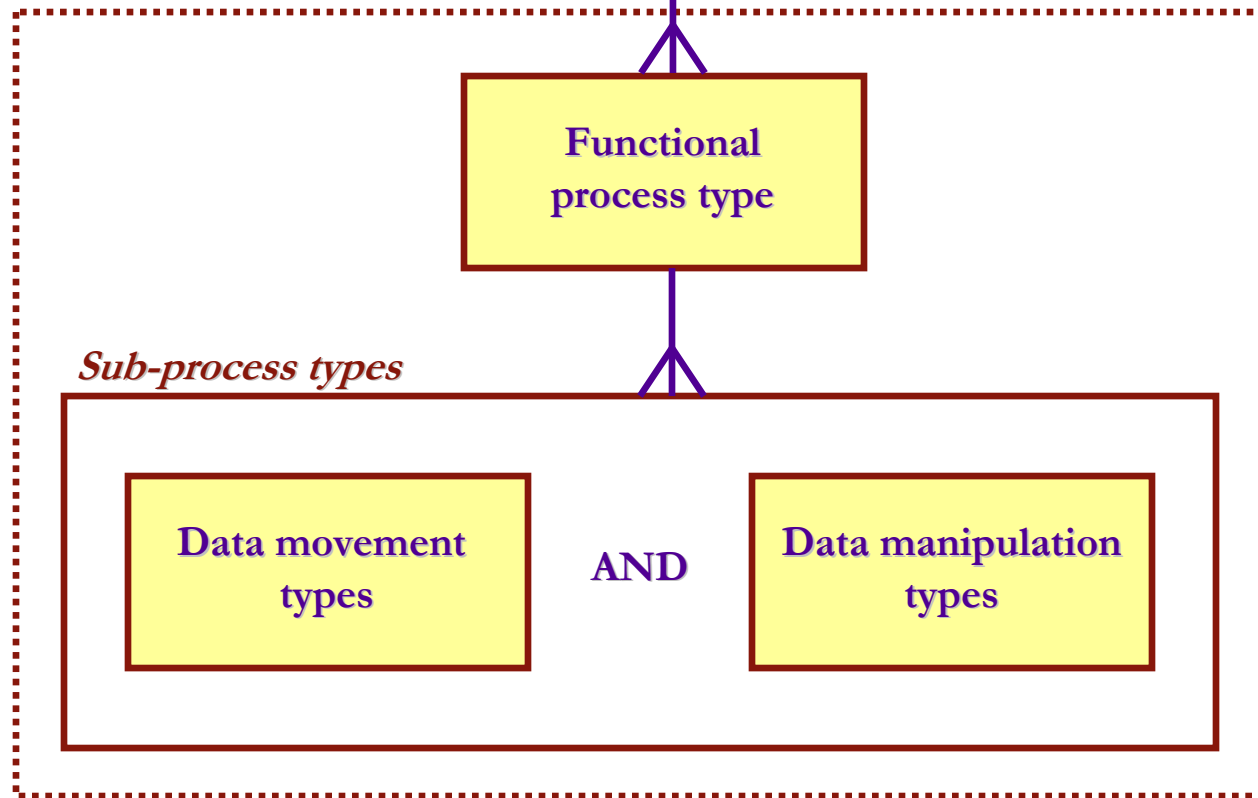


COSMIC model of software FURs

COSMIC FFP Overview

F.U.R.

Software



Functionality = Data movements and Data manipulations

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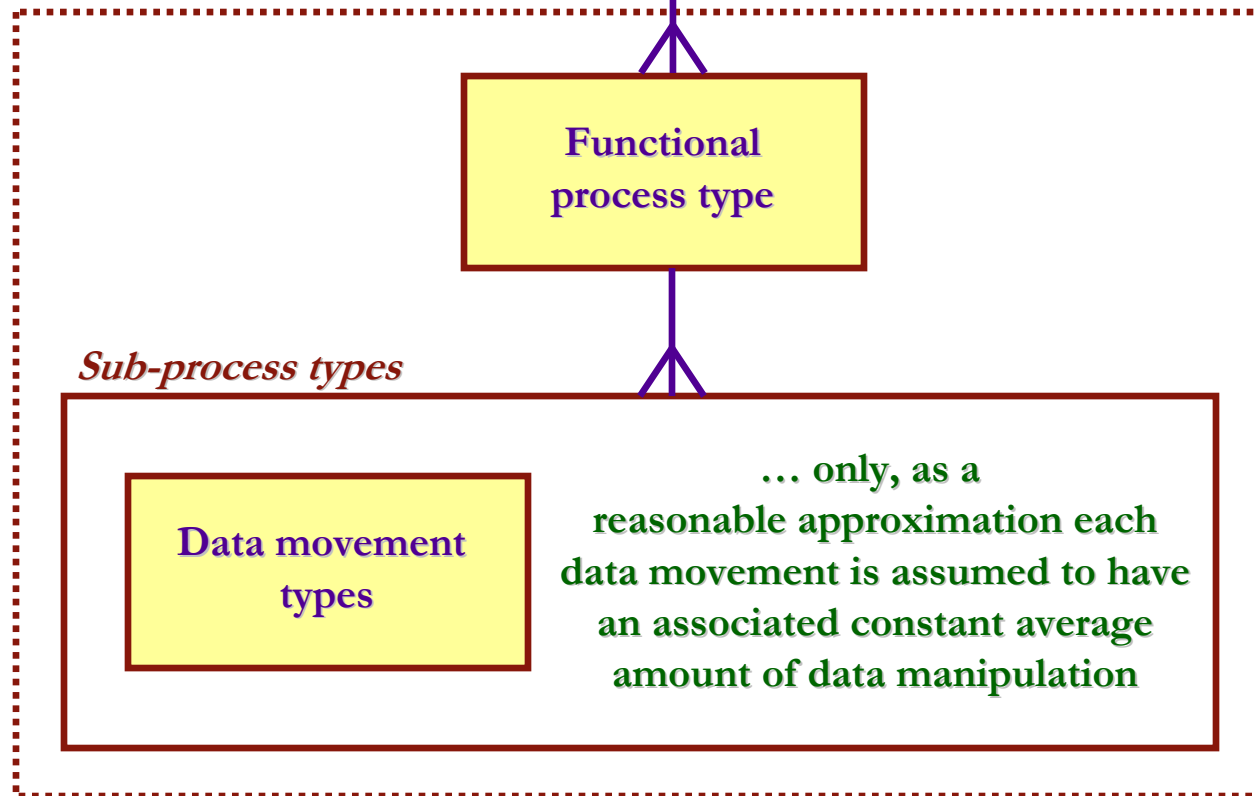


COSMIC model of software FURs

COSMIC FFP Overview

F.U.R.

Software



Functionality = Data movements + some processing

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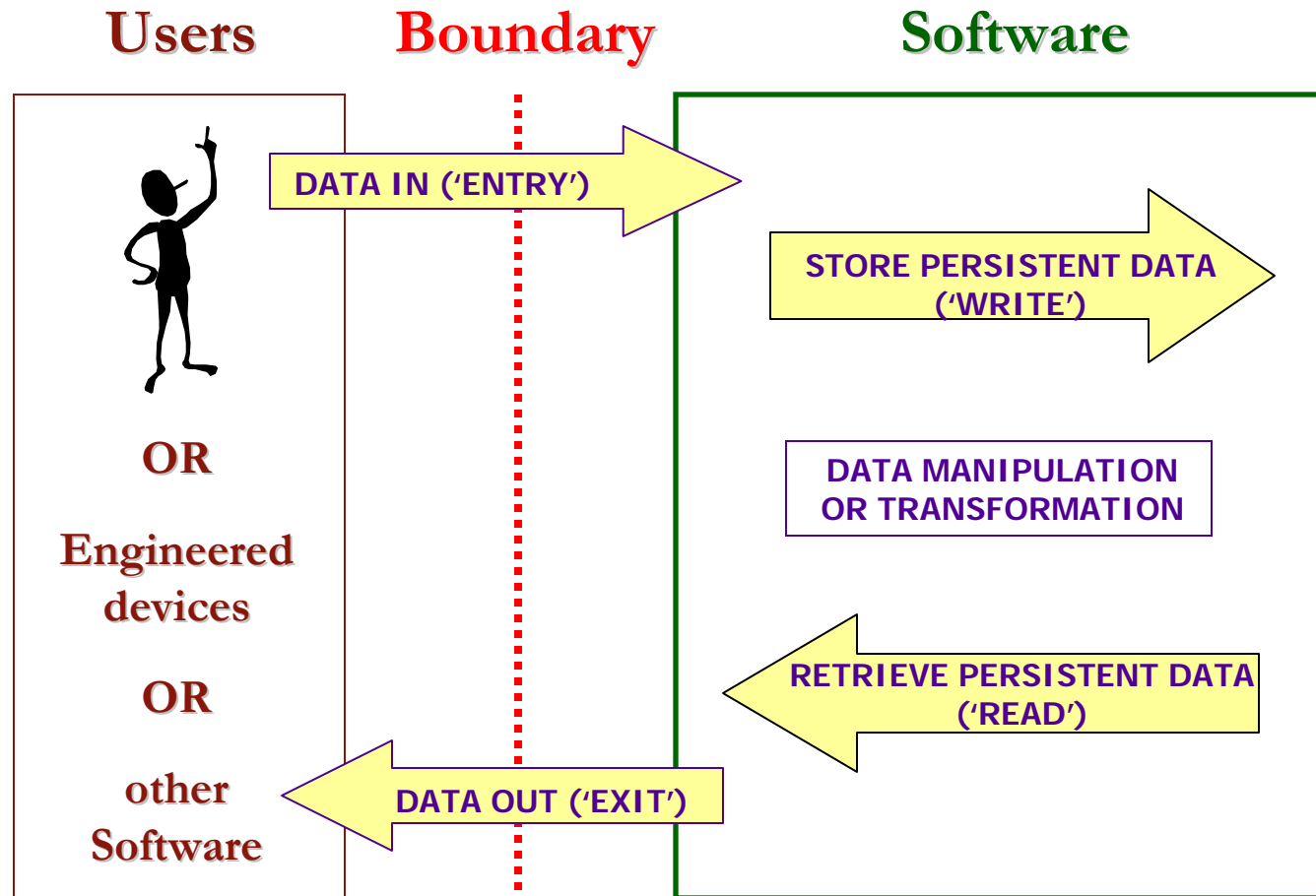
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User view of software functional requirement components

COSMIC FFP Overview



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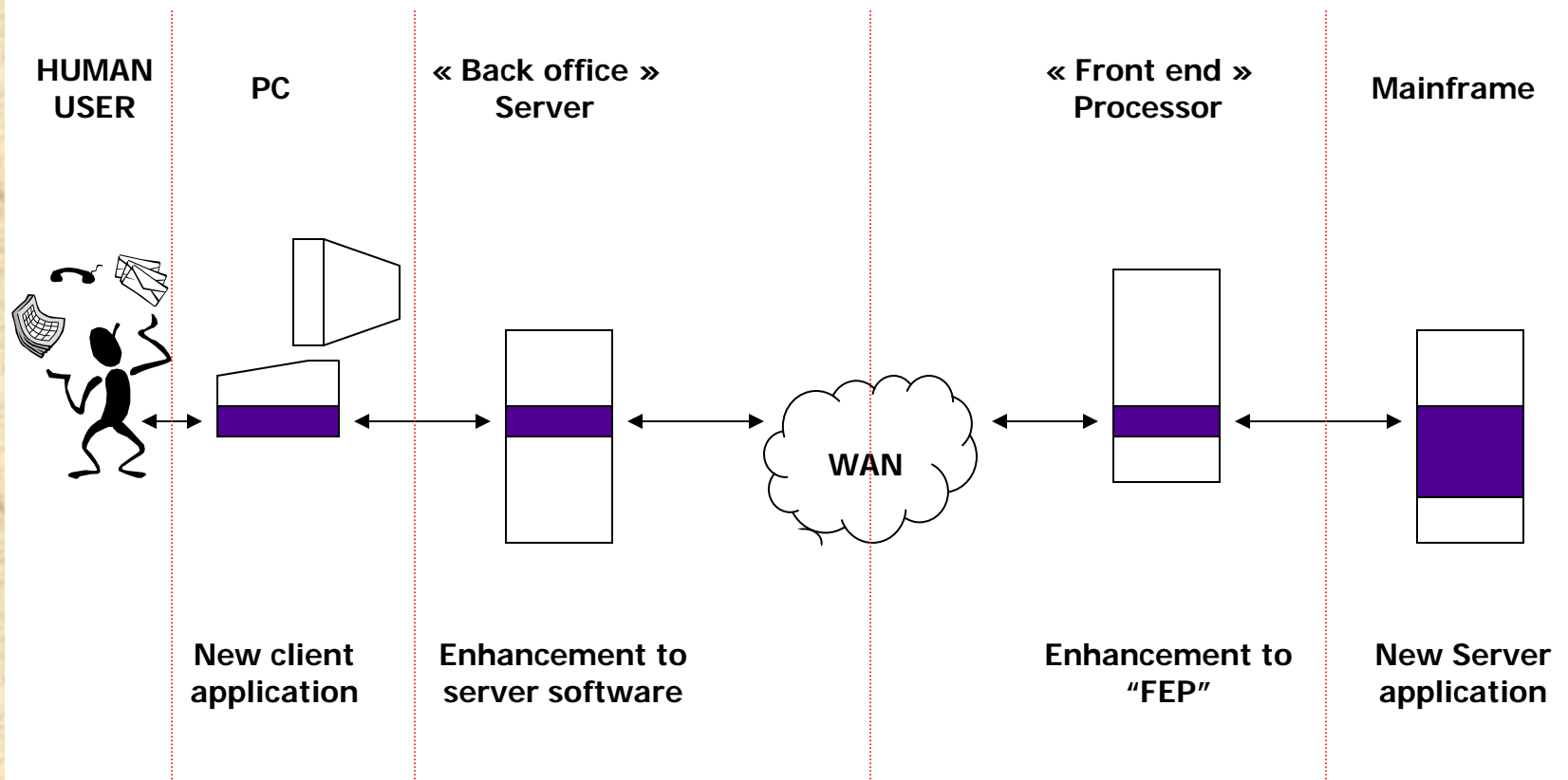
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Boundary: example 1

BOUNDARIES



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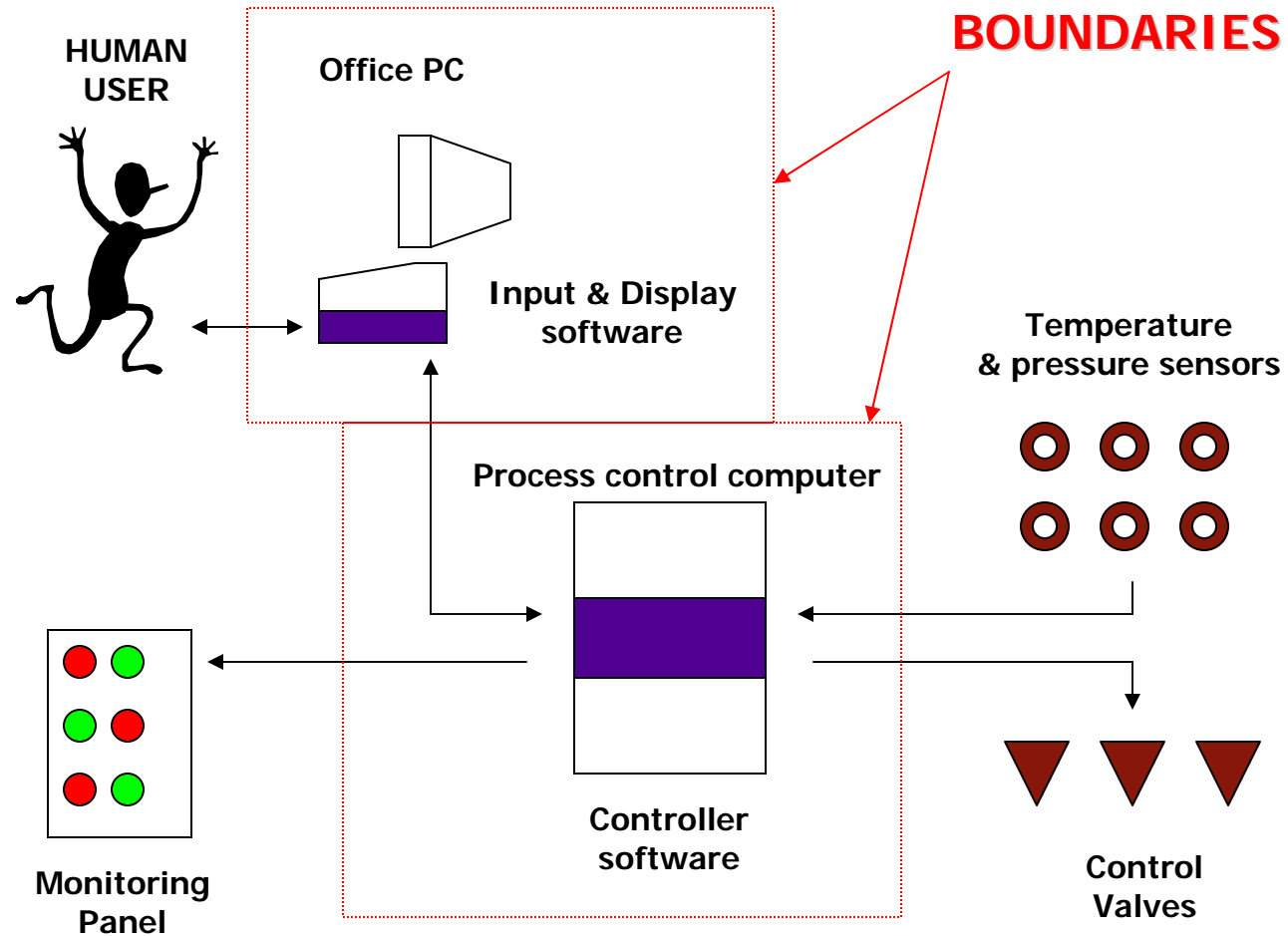
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NOTE: Each piece of software is the user of the next piece across their shared boundary



Boundary: example 2



NOTE: All physical devices and the "Input & Display" software are users of the "controller" software.

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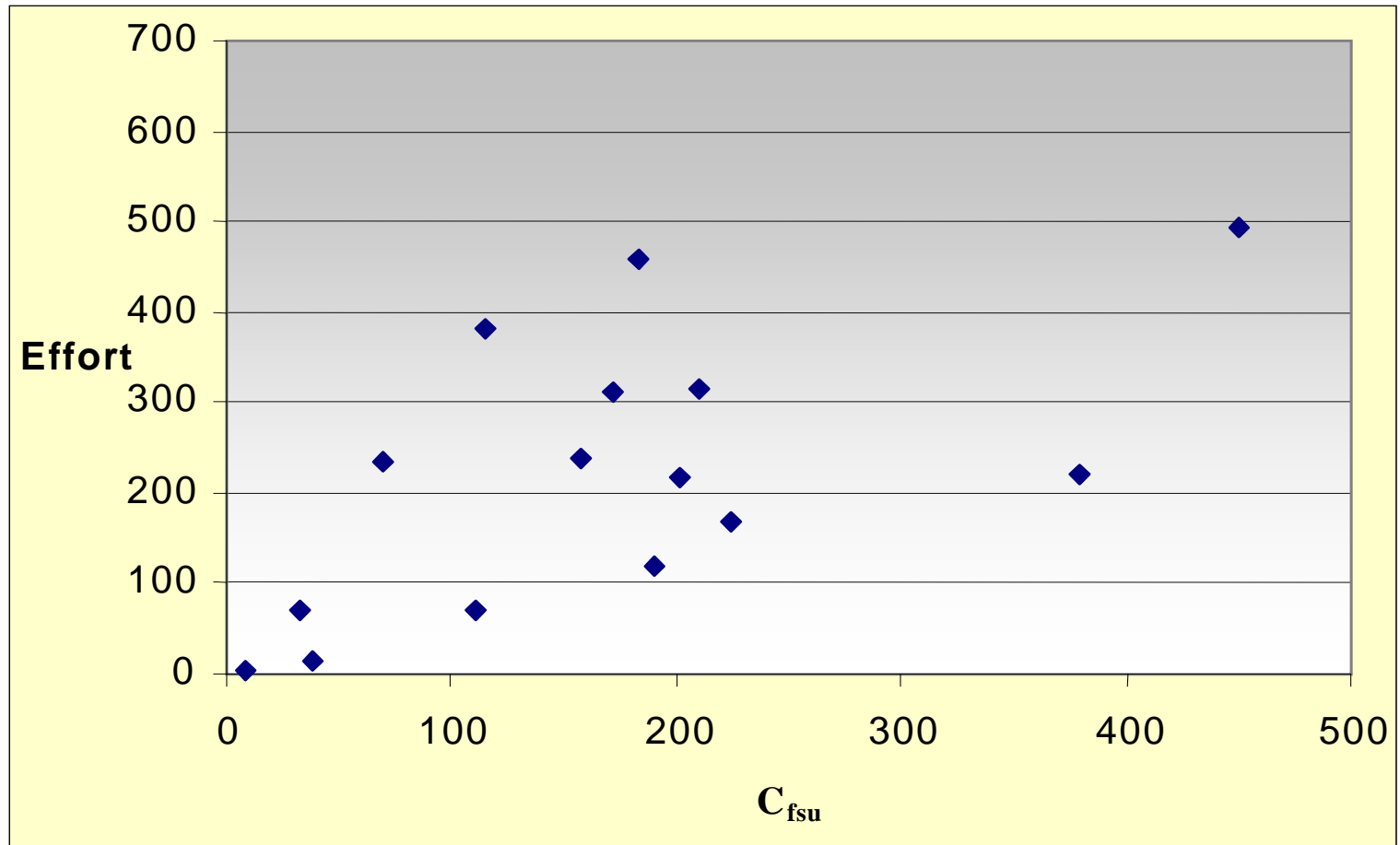
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Web-based linguistic Software (15 projects)



Source: Abran, Silva, Primera 2002

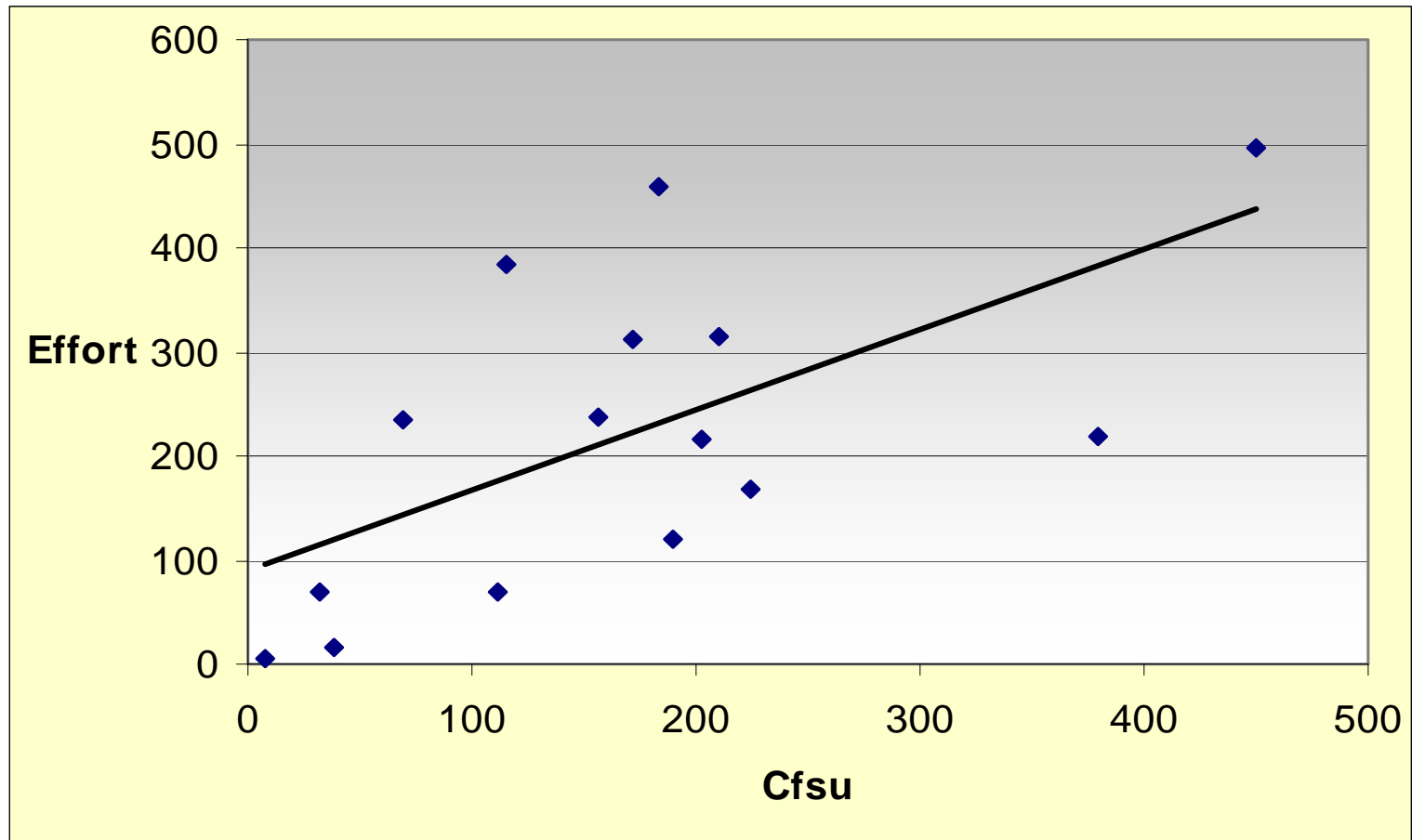
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Web-based Linguistic Software Regression Model – 1 Variable: Size in Cfsu N = 15 projects



Source: Abran, Silva, Primera 2002

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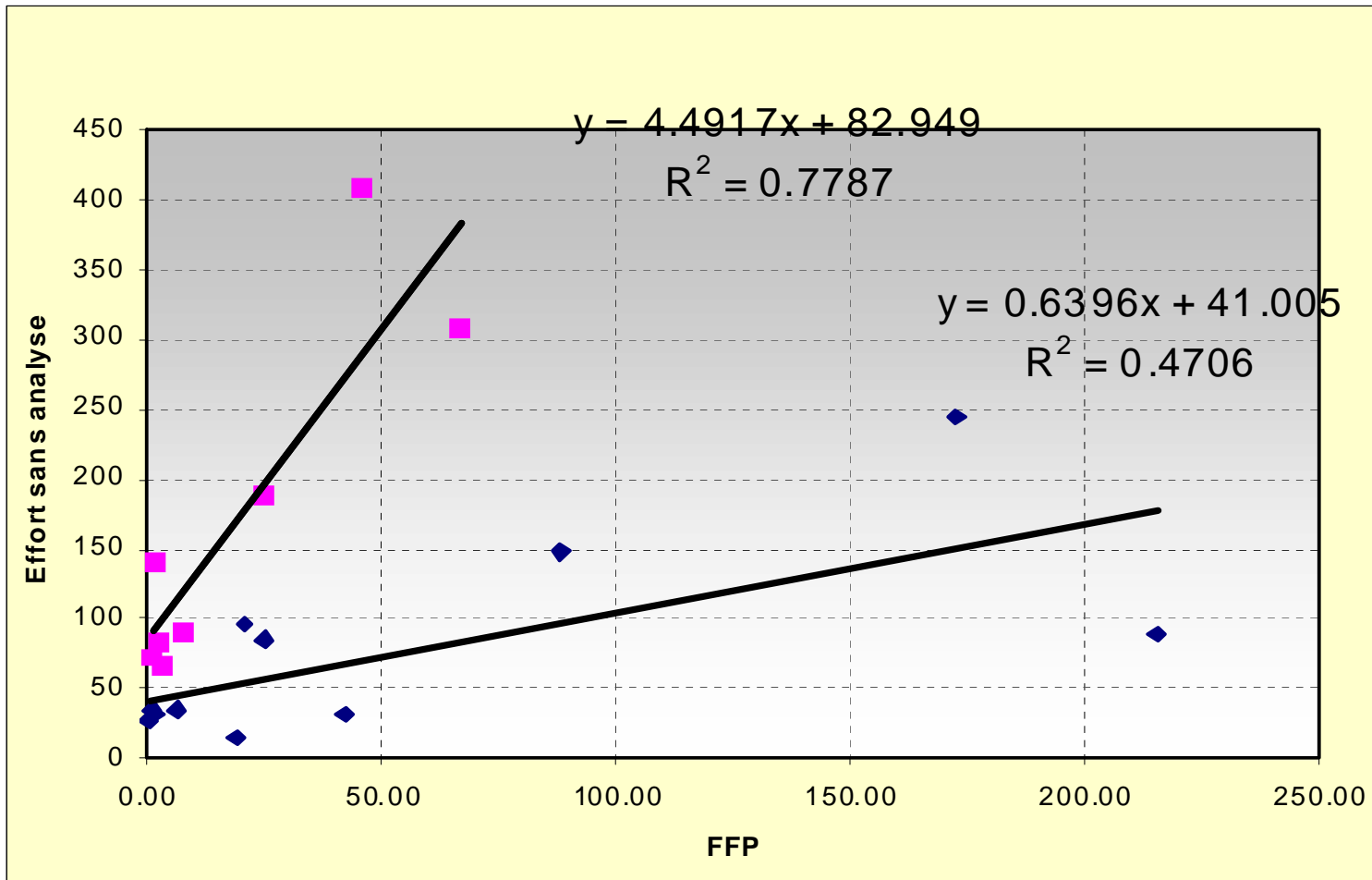
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Defence – Real-time Software N = 14 projects

Multiplicative model with Size and Difficulty



Source: Abran, Silva, Primera 2002

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Current Status

- ISO standard 19761
- Recommended in ISO 90003
- Recognized as a standard for benchmarking data collection:
 - International Software Benchmarking Standards Group – ISBSG
- Available free on the web
 - www.gelog.etsmtl.ca/cosmic-ffp
- Certification – Entry level
- 2006 Award Medallist – British Computer society

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Convertibility Studies

| Source | Convertibility Equation | R ² Max=1 |
|--------------------|---|-------------------------|
| Fetcke 1999 | $Y(\text{Cfsu}) = 1.1 * (\text{UFP}) - 7$ | 0,97 |
| Letherhuis 2003 | $Y(\text{Cfsu}) = 1.2 * (\text{UFP}) - 87$ | 0,99 |
| Desharnais 2005 | $Y(\text{Cfsu}) = 0.84 * (\text{UFP}) + 18$ | 0,91 |
| 2006 | $Y(\text{Cfsu}) = 1.0 * (\text{UFP}) - 3$ | 0,93 |

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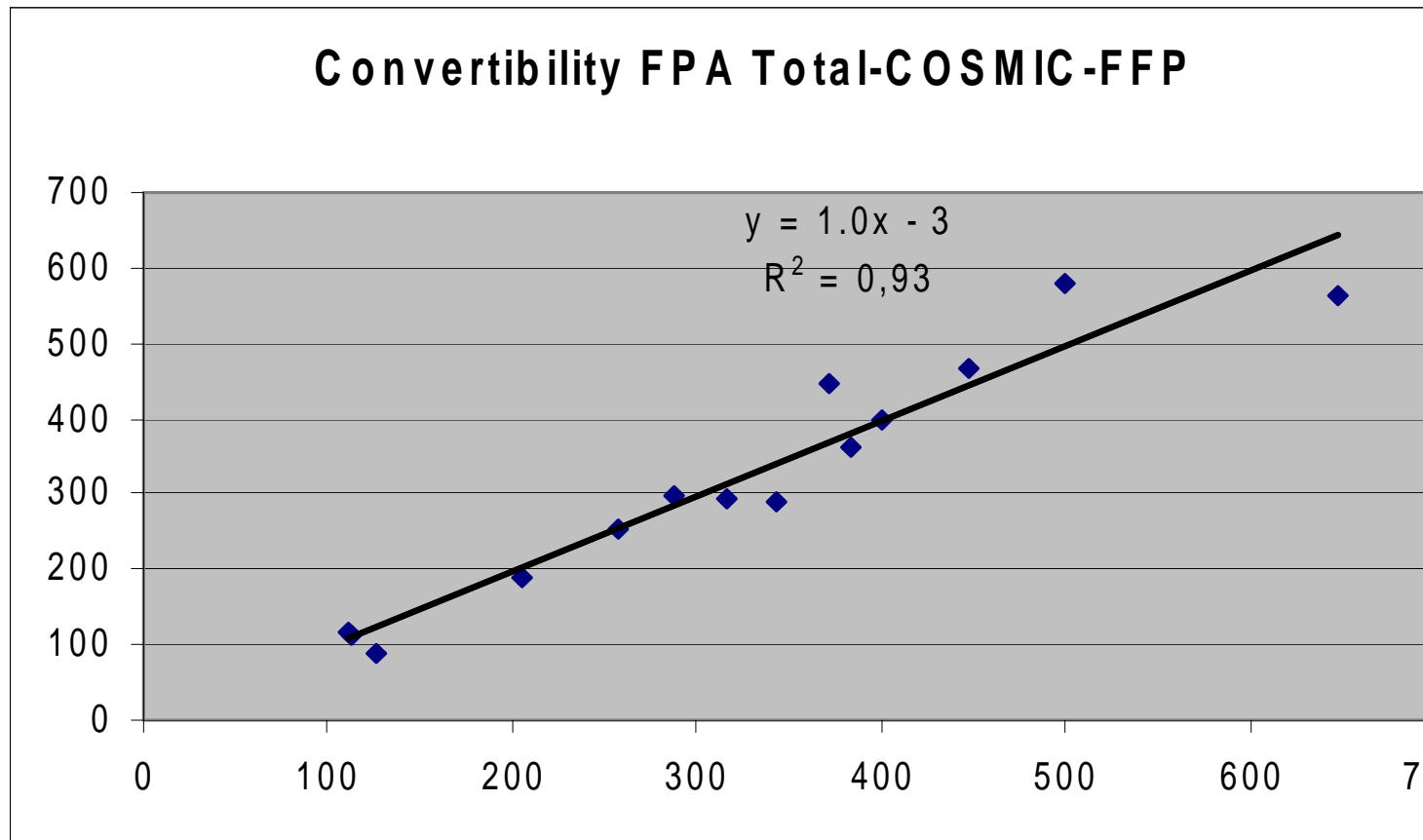


Figure 4: Convertibility model on Total FPA Size (N=14)

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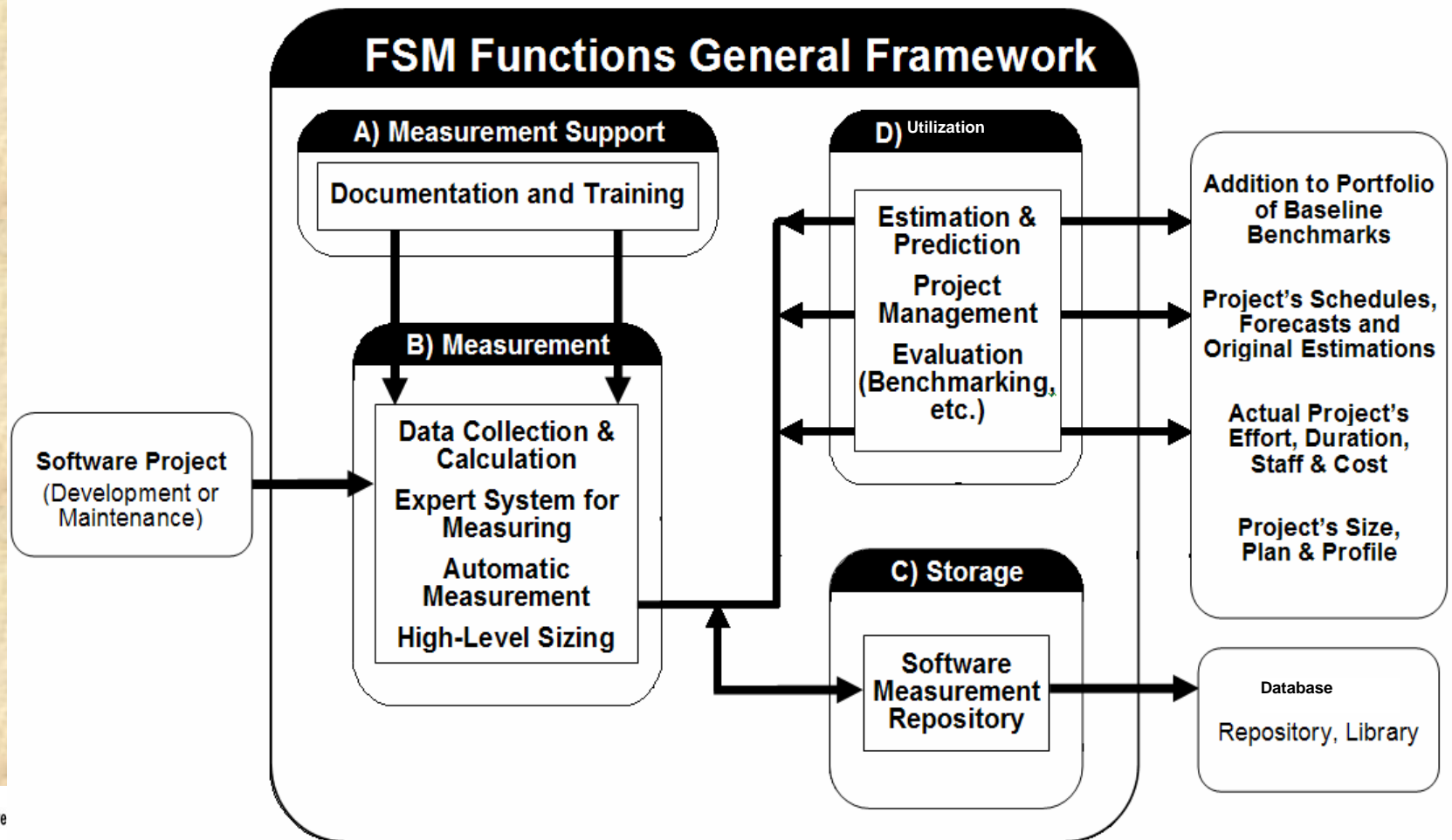
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FSM Functions General Framework



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| FSM Key Dimensions (4) | Tool Categories (10) |
|-------------------------------|--|
| A) Measurement Support | <ul style="list-style-type: none"> - Documentation - Training |
| B) Measurement | <ul style="list-style-type: none"> - Data Collection & Calculation - Expert System for Measuring - Automatic Measurement - High-Level Sizing |
| C) Storage | <ul style="list-style-type: none"> - Software Measurement Repository |
| D) Utilization | <ul style="list-style-type: none"> - Estimation & Prediction - Project Management - Evaluation (Benchmarking, etc.) |

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| Tool Categories (10) | COSMIC Xpert | ISBSG | MeterIT-Cosmic MeterIT-Project PredictIT | Experience Pro | Knowledge Plan | SIESTA |
|---------------------------------|--------------|-------|--|----------------|----------------|--------|
| Documentation | X | | X | | | |
| Training | X | | X | | | |
| Data Collection & Calculation | | | X | X | X | X |
| Expert System for Measuring | X | | | | | |
| Automated Measurement | | | | | | |
| High-Level Sizing | | | X | X | X | X |
| Software Measurement Repository | | X | X | X | X | |
| Estimation & Prediction | | | X | X | X | X |
| Project Management | | | X | X | X | X |
| Evaluation (Benchmarking, etc.) | | X | X | X | X | |

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- *Major gap in automation*
- *Research prototypes in progress:*
 - **XForms-Format** – Li – Waseda U.
 - **μcROSE, ROOM** – Diab et al. U. Sherbrooke
 - **COSMIC-RUP** - Azzouz – UQAM-ETS
 - **Ontological formalization** – Bevo – UQAM
 - **OO-Method RMFFP** – Condori-Pastor - Valencia

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Innovative Uses in Quality

- Functional complexity
- Scenario-driven black-box testing strategies:
 - Real-time software with state diagrams
 - SAP projects
- Reliability prediction
- Reviews & Inspection support

- Early estimation: scaling factors

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Usefull Web Addresses

- www.gelog.etsmtl.ca
- www.gelog.etsmtl.ca/publications
- www.gelog.etsmtl.ca/cosmic-ffp
- www.swebok.org
- www.jtc1sc7.org

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Thank You !



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